REMARKS

Applicant appreciates the detailed examination evidenced by the Office Action mailed January 11, 2008 ("Office Action"), and more particularly, the indication that Claim 14 recites patentable subject matter. Applicant has amended Claim 7 to correct the dependency error noted in the Office Action and has amended Claim 3 to correct a minor typographical error. Applicant requests reconsideration and withdrawal of the rejections of Claims 1-13 and 15-25 for at least the reasons discussed below.

Independent Claims 1, 4, 17 and 20 are patentable

Independent Claim 1 recites:

> A power converter apparatus comprising a multi-resonant circuit comprising a series-resonant circuit and a frequency-dependent impedance connected in series with the series-resonant circuit and operative to counteract an inductance of the series-resonant circuit, a switching circuit operative to alternately apply first and second voltages to an input of the multi-resonant circuit, and a rectifier circuit coupled to an output of the multi-resonant circuit.

In rejecting Claim 1 as allegedly obvious over a combination of U.S. Patent No. 4,533,986 to Jones ("Jones") in combination with U.S. Patent No. 4,903,181 to Seidel ("Seidel"), the Office Action asserts that Jones teaches "series-resonant circuit (figure 1-2), a counteract an inductor (column 12, line 1-35), a switching circuit (figure 1, item 27-28), a rectifier (figure 1, item 33-34), an increase in frequency (column 7, line 30-65), a second series resonance circuit (figure 2, 40-41 and 45-46)." Office Action, p. 3. The Office Action further asserts that Seidel teaches "the utilization of the similar technique for a frequency-dependent impedance connected in series with the series resonant (figure 1 and column 4, line 5-60)" and that it would have been obvious "to modify Jones's power supply circuit by utilizing the technique taught by Seidel for the purpose of increasing efficiency and protection of the power supply." Office Action, p. 3. This reasoning is erroneous for several reasons.

Figs. 1 and 2 of Jones illustrate two different configurations of a power supply. The configurations employ two different series resonant half-bridge converters 14, 14'. There is nothing in either of these configurations that appears to correspond to "a multi-resonant

circuit comprising a series-resonant circuit and a frequency-dependent impedance connected in series with the series-resonant circuit and operative to counteract an inductance of the series-resonant circuit." The phrase "counteract an inductor" referred to in the Office Action in relation to column 12, lines 1-35 of Jones appears to refer to a variant of a boost converter 12' illustrated in Fig. 4, which may be substituted for the boost converters 12 of the two different power supplies illustrated in Figs. 1 and 2. *See* Jones, column 11, lines 5-14. As described in Jones, an inductor 71 of the boost converter 12' is used to provide an impedance during switching of a transistor switch 19 of the boost converter 12'. *See* Jones, column 11, line 63 through column 12, line 5. There is nothing in this material from Jones that discloses or suggests "a frequency-dependent impedance connected in series with the series-resonant circuit and operative to counteract an inductance of the series-resonant circuit," as recited in Claim 1. The Office Action appears to concede this to some degree, stating "Jones does not disclose the utilization of the technique for a frequency-dependent impedance connected in series with the series resonant." Office Action, p. 3.

However, contrary to the assertions of the Office Action, Seidel does not provide such a teaching. The cited material from column 4 of Seidel describes a quarter wave phase shift impedance transformation circuit 115 shown in Fig. 1. The input of the impedance transformation circuit 115 is coupled to the output of an inverter 110, and serves to constrain power flow therethrough to a signal frequency to reduce switching losses in switches 111, 112 of the inverter 110. *See* Seidel, column 4, lines 4-23. There is nothing in Seidel that suggests that this circuit serves to "counteract an inductance of the series-resonant circuit." Moreover, the Office Action fails to indicate how one skilled in the art would include the cited circuitry from Seidel in a circuit such as that shown in Jones, or how inclusion of such circuitry in Jones would result in "increasing efficiency and protection of the power supply," as Jones does not appear to include anything corresponding to the inverter 110 that the cited quarter wave phase shift impedance transformation circuit 115 of Seidel is designed to protect.

Accordingly, the cited combination of Jones and Seidel does not disclose or suggest several of the recitations of independent Claim 1, and the Office Action fails to provide a rational basis for combining these references to produce the recitations of independent

Claim 1. For at least these reasons, Applicant submits that independent Claim 1 is patentable. Applicant further submits that independent Claim 17 is patentable for at least similar reasons.

Independent Claim 4 recites:

> A power converter apparatus, comprising:
> a multi-resonant circuit comprising cascaded first and second series-resonant stages having respective first and second resonant frequencies;
> a switching circuit operative to alternately apply first and second voltages to an input of the multi-resonant circuit; and
> a rectifier circuit coupled to an output of the multi-resonant circuit.

In rejecting independent Claim 4 as allegedly obvious with respect to a combination of Jones, Seidel and U.S. Patent No. 5,051,706 to Zushi, the Office Action states "Jones in combination with Seidel discloses claimed subject matters as explained in the claims 1-3, 12-13, and 15-16, above, except the utilization of the technique for a cascaded first and second series resonant states." Office Action, p. 3. The Office Action states that "Zushi teaches the utilization similar technique for a cascaded first and second series resonant stages (Abstract, line 1-25 and figure 5-7)," and that it would have been obvious "to modify Jones in combination with Seidel's power supply circuit by utilizing the technique taught by Zushi for the purpose of increasing efficiency and protection of the power supply." Office Action, pp. 3 and 4.

For reasons discussed above, there is no rational basis for combining Jones and Seidel in the manner proposed in the Office Action, so there is also no rational basis for combining Jones, Seidel and Zushi. The circuit described in Zushi is a power amplifier for a transmitting stage of a radio communications apparatus. *See* Zushi, column 1, lines 7-9. The circuits in Figs. 5-7 of Zushi incorporates series resonant networks 24, 24', 26, 26' that serve to shunt signals at half the operating frequency (f/2) at terminals of transistors 9, 41 to ground to prevent these signals being amplified and resulting in unwanted oscillation at f/2, operations that are explained with reference to Fig. 1. *See* Zushi, column 3, lines 43-58. These series-resonant circuits are not ***cascaded***. Accordingly, Zushi does not teach "cascaded first and second series resonant stages." Moreover, the Office Action provides no reasoning as to how the circuitry shown in Zushi would be combined with circuitry shown in Jones and Seidel, or how such a combination would result in " increasing efficiency and

protection of the power supply," particularly considering that Zushi relates to a radio-frequency (RF) transmitter power amplifier, not a power supply.

Accordingly, the cited combination of Jones, Seidel and Zushi does not disclose or suggest several of the recitations of independent Claim 4, and the Office Action fails to provide a rational basis for combining these references to produce the recitations of independent Claim 4. For at least these reasons, Applicant submits that independent Claim 4 is patentable. Applicant further submits that independent Claim 20 is patentable for at least similar reasons.

The dependent claims are patentable

Applicant submits that dependent Claims 2, 3, 5-16, 18, 19, and 21-25 are patentable at least by virtue of the patentability of the respective ones of independent Claims 1, 4, 17 and 20 from which they depend. Applicant further submits that several of the dependent claims are separately patentable. In particular, Applicant submits that the rejections of the dependent claims are erroneous for at least the additional reason that the Office Action fails to provide specific bases for the rejections of the dependent claims, as the rejections include no reference or only a passing reference to the recitations of the dependent claims.

For example, for Claim 2, which recites "wherein the frequency-dependent impedance decreases with an increase in frequency at which the first and second voltages are applied to the multi-resonant circuit," the Office Action merely refers to "an increase in frequency (column 7, line 30-65)" of Jones. Office Action, p. 3. The only reference to an "increase in frequency" in this passage states:

> If the voltage across the IC changes in respect to a reference internal to the IC, the square wave output frequency will increase (or decrease).

Jones, column 7, lines 54-56. Respectfully, this has nothing to do with the recitations of Claim 2.

Regarding Claim 3, which recites " wherein the frequency-dependent impedance comprises a second series-resonant circuit," the Office Action refers to "a second series resonance circuit (figure 2, 40-41, and 45-46)" of Jones. Office Action, p. 3. Items 40, 41 of Jones are capacitors of a capacitive energy storage circuit 13', not a series-resonant circuit.

Items 45, 46 are, respectively, a capacitor and inductor of a series-resonant half bridge converter 14', but this is not a "***second*** series resonant circuit" because the Office Action already appears to refer to the series-resonant half bridge converter 14' as the recited "first series-resonant circuit." *See* Office Action, p. 3. There appears to be only one series-resonant circuit in each of the power supply circuits shown in Jones.

Finally, the Office Action fails to provide any specific reference as to where the cited references teaches the recitations of dependent Claims 5-13, 15, 18, 19 and 21-25. Should the rejections of the dependent claims be maintained, Applicant requests that specific bases for the rejections be provided, including specific reference to all of the claim recitations and specific citation as to where the references allegedly teach such recitations.

Conclusion

Applicant respectfully submits that all of the claims are in condition for allowance, and requests allowance of the claims and passing of the application to issue in due course. Applicant encourages the Examiner to contact Applicant's undersigned representative at (919) 854-1400 to resolve any remaining formal issues.

Respectfully submitted,

Robert M. Meeks
Registration No. 40,723

Customer No. 20792
Myers Bigel Sibley & Sajovec
P. O. Box 37428
Raleigh, North Carolina 27627
Telephone: (919) 854-1400
Facsimile: (919) 854-1401

CERTIFICATION OF TRANSMISSION

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Candi L. Riggs